

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 shows a wiring structure of a conventional folding mobile phone;

FIG. 2 shows another wiring structure of another conventional folding mobile phone;

FIG. 3A is a plane view showing a normal folded position of a folding mobile phone according to a preferred embodiment of this invention;

FIG. 3B is a plane view showing an unfolded position of the folding mobile phone of FIG. 3A;

FIG. 3C is a plane view showing a transition state of the folding mobile phone of FIGS. 3A and 3B;

FIG. 3D is a plane view showing a reverse folded position of the folding mobile phone of FIGS. 3A to 3C;

FIG. 4 is a block diagram showing an internal composition of the holding mobile phone of FIGS. 3A to 3D;

FIG. 5 is an oblique perspective view of a hinge mechanism used in a hinge portion of the holding mobile phone of FIGS. 3A to 3D;

FIG. 6 is an exploded perspective view of the hinge mechanism of FIG. 5;

FIG. 7A is a plane view of a first example of a first type FPC in a spread state;

FIG. 7B is a plane view of a second example of the first type FPC in a spread state;

FIG. 7C is a plane view of a first example of a second type FPC in a spread state;

FIG. 7D is a plane view of a second example of the second type FPC in a spread state;

FIG. 8 is an exploded perspective view for describing process of attachment of the FPCs to the hinge mechanism shown in FIG. 5;

FIG. 9 is an oblique perspective view of a resulting wiring device with the FPCs attached to the hinge mechanism of FIG. 5;

FIG. 10 is an oblique perspective view of the wiring device with one left-side FPC;

FIG. 11 is an oblique perspective view of the wiring device with one right-side FPC;

FIG. 12 is an oblique perspective view of the wiring device with a T-shaped FPC;

FIG. 13 is a plane view of the wiring device of FIG. 12;

DESCRIPTION OF THE PREFERRED EMBODIMENT:

Referring to FIG. 1, description will be first directed to a conventional wiring structure of a conventional mobile phone.

In FIG. 1, a folding mobile phone comprises a lower unit **1100** with a first circuit **1110** and an upper unit **1200** with a second circuit. The lower unit **1100** and the upper unit **1200** are mechanically connected to each other by the means of a hinge mechanism **1300** so that they are folded/unfolded in relation to each other. The first circuit **1110** and the second circuit **1210** are electrically connected to each other by signal lines **1400**. The signal lines **1400** are loosely wound around a shaft of the hinge mechanism **1300** to make several turns at midpoints of them. Such a folding mobile phone is described in Japanese Unexamined Patent Publication (JP-A) No. Tokkaihei 9-153931.

Referring to FIG. 2, another conventional mobile phone comprises a flexible print circuit **2400** connecting a first circuit **2410** to a second circuit **2420**. The flexible print circuit **2400** is wound at midpoint thereof and incorporated into a hinge mechanism **2300** mechanically connected

between a lower unit **2100** and an upper unit **2200**. Such a folding mobile phone is described in Japanese Unexamined Patent Publication (JP-A) No. Tokkai 2002-300247.

The conventional wiring structures mentioned above are available for the folding mobile phones. However, they are not available for a folding mobile phone having a two axes type hinge mechanism.

Referring to FIGS. 3A to 3D, description will be made about a folding mobile phone according to a preferred embodiment of this invention.

FIG. 3A is a plane view showing a normal folded position of the folding mobile phone **10**. FIG. 3B is a plane view showing an unfolded position of the folding mobile phone **10**. FIG. 3C is a plane view showing a transition state of the folding mobile phone **10**. FIG. 3D is a plane view showing a reverse folded position of the folding mobile phone **10**.

As shown in FIGS. 3A to 3D, the folding mobile phone **10** comprises a lower unit **100**, an upper unit **200** and a two axes type hinge portion **300** connecting the lower unit **100** and the upper unit **200** to each other. The hinge portion **300** enables the upper unit **200** to move with respect to the lower unit **100** in a folding/unfolding direction **D1** and a rotative direction **D2** as mentioned later. The lower unit **100** provides a key operating portion (or a key set) **101** including numeric keypads and a microphone **102** at a main surface thereof. The upper unit **200** provides an oblong (main) display **201**, a speaker **202** and an assistant operating portion **203** at a main surface thereof.

In FIG. 3A, the lower unit **100** and the upper unit **200** are folded and their main surfaces confront each other in close proximity. Accordingly, the key operating portion **101** and the display **201** are hidden and protected by the lower and the upper units **100** and **200**. The upper unit **200** further provides an assistant display **204** for display simple information.

The folding mobile phone **10** in the normal folded position of FIG. 3A goes into the unfolded of FIG. 3B when the upper unit **200** is moved in the unfolding direction **D1** with respect to the lower unit **100**. The hinge portion **300** restricts an unfolded angle between the main surfaces of the lower and the upper units **100** and **200** to about 180 degrees.

In FIG. 3B, the lower and the upper units **100** and **200** expose their main surfaces outside. That is, the key operating portion **101**, the microphone **102**, the display **201** and the speaker **202** can be seen from the outside. The unfolded position allows the user to operate the key operating portion **101** and to speak by the folding mobile phone **10**. The hinge portion **300** may limit the unfolded angle to about 160-170 degrees in the unfolded position.

The hinge portion **300** enables the upper unit **200** to rotate in the rotating direction **D2** with respect to the lower unit **100**. Furthermore, the hinge portion **300** restricts a rotation angle of the upper unit **200** to about 180 degrees in each of clockwise and counterclockwise directions from the unfolded position of FIG. 3B. Thus, the folding mobile phone **10** in the unfolded position of FIG. 3B can go into the reverse folded position of FIG. 3D via the transition state illustrated in FIG. 3C. The hinge portion **300** may increase the unfolded angle between the main surfaces of the lower and the upper units **100** and **200** to 180 degrees during the transition from the unfolded position of FIG. 3B to the reverse folded position of FIG. 3D.

The hinge portion **300** has stable positions (or click positions) for the normal folded position of FIG. 3A, the unfolded position of FIG. 3B and the reverse folded position of FIG. 3C. The hinge portion **300** may have one or more